

Occupancy Management Reference Platform

Accurate, anonymous, battery operated people detection sensors

With the high cost of office workspace, companies are increasingly focusing on whether the available space is being well utilised.

Employees that do not work permanently at the office are now using shared desks. This brings a need to monitor if desks are available and to measure their utilization. A simple reservation system does not consider actual usage so still leads to inefficient allocation of space and potential employee frustration.

The same problem exists for shared resources such as meeting rooms. There is wide usage of meeting reservation systems but are the reservations actually being used? Sometimes meeting rooms are used without reservations. How does an employee know which meeting room is available?

What is needed is a system that can determine desk or meeting room occupancy accurately that is simple and inexpensive to install and maintain.

The Occupancy Management Reference platform from LYNRED and GreenWaves Technologies uses an Infra Red sensor and an ultra-low-power processor especially designed for on-board Artificial Intelligence to provide an easy to install, battery operated occupancy management sensor.

Highlights

- Accurate, privacy respecting, indoor people detection and counting
- Compatible with years of operation on batteries
- Flexible, programmable platform
- All platform elements supplied under permissive, open source licenses
- Reference board and firmware provides easy prototyping and evaluation
- Complete solution reduces integration and productization risk

Reference platform

GAPPoc B Reference Board

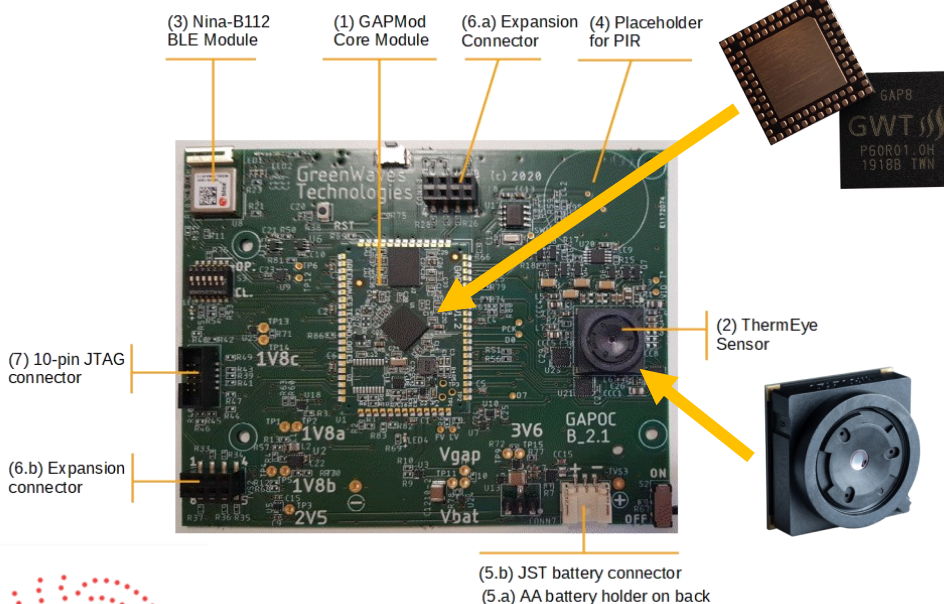
A functional PCB including the sensor, processor and a Bluetooth Low Energy radio for algorithm evaluation and proof of concept. Headers exposing debug and other interfaces for additional sensors.

GAP8 IoT Application Processor

Multicore, MCU-class processor for embedded intelligence in edge devices such as IoT sensors and hearable devices.

Lynred ThermEye™ IR Sensor

Ultra-low-power, 80 x 80 pixel, thermal imager available in two different lens configurations: 90° and 120° field of view.



Occupancy Management Applications

Some key challenges in providing a sensor to detect meeting room occupancy are:

- Accuracy – The sensor needs to provide accurate results
- Installation – Wireless, battery operated sensors greatly reduce installation costs however they need to last for several years or the cost and disturbance of changing batteries becomes an issue
- Privacy – The sensor cannot capture sounds or visual spectrum images since this is generally unacceptable to employees and may be against local legislation.

LYNRED and GreenWaves Technologies have teamed up to provide the tools necessary to build sensor solutions which meet these requirements.

The core occupancy management reference platform contains the hardware and software necessary to detect people and provides the sensor application with coordinates of bounding boxes around the detected people. Production designs can add other detection algorithms using the IR camera, other simple sensors such as temperature or humidity or even additional rich data sensors such as radar, sound or visual spectrum cameras.

This means that the reference platform can be used to create sensors that are applicable in a wide range of different applications.

Desk occupancy detection
Meeting room utilisation
Shared space utilization
Cleaning scheduling
Cafeteria occupancy management
Security
Fallen person detection
Smart energy management

Reference Platform Features

Core elements

- ◆ GreenWaves Technologies GAP8 IOT Application Processor
- ◆ LYNRED ThermEye infrared camera
- ◆ Bluetooth Low Energy radio module
- ◆ Reference board
- ◆ Reference people detection algorithm
- ◆ Reference board firmware
- ◆ Reference Android application displaying detected people
- ◆ All source code, neural network training code, labelled training images and demo board hardware design is provided under permissive, open source licenses

GAP8

- ◆ 9 core, RISC V based MCU class processor
- ◆ Enable artificial intelligence and signal processing at the very edge of the network
- ◆ Analyse images, sounds and vibrations inside battery operated sensors
- ◆ Dramatically reduce sensor installation and operating costs
- ◆ Eliminate data privacy concerns through local analysis
- ◆ Highly integrated design brings low total system cost
- ◆ Fully programmable, multi-core architecture keeps pace with fast changing DNN models

ThermEye™ IR Sensor

- ◆ 80 x 80 pixels
- ◆ 90° or 120° Field of View
- ◆ Full digital
- ◆ -10°C to + 50°C operating temperature

GAPPoc B Reference Board

- ◆ GAPMod 2.2 core module with 64Kbit RAM and 128Kbit Flash on Quad-SPI Bus,
- ◆ LYNRED ThermEye 120 Thermal Infra-Red sensor
- ◆ uBlox NINA-B102 Bluetooth Low Energy (BLE) module with integrated antenna and pre-Flashed firmware to support GATT profiles through AT commands and a Serial Port Service ("wireless UART").
- ◆ Slot for a through-hole PIR
- ◆ AA cylindrical battery holder, plus JST battery connector for separate holder of 3 AA/AAA NiMh batteries.
- ◆ 2.54mm pitch expansion female connectors, dual-entry
- ◆ 10-pin, 1.27mm pitch male JTAG connector.
- ◆ Switches and status LEDs (1 LED and 1 Switch available for applications)

Reference firmware

- ◆ Sample application including GAP8 firmware and people detection algorithm
- ◆ Continuous detection

- ◆ Transmission of bounding box information over Bluetooth Low Energy connection to Android Application
- ◆ Android Application displaying location of detected people

Training data

- ◆ 7310 labelled images
- ◆ Collected from multiple sensors in different scenarios

Firmware Build

- ◆ GAP Software Development Kit
- ◆ End to end production of GAP code from Keras people detection network
- ◆ Network can be retrained or fine tuned with application specific data

Power Consumption

- ◆ Wake up, acquire a single image, run people detection and go to standby 24 hours a day 365 days a year (no wireless transmission or battery self discharge included):
 - ◆ 1 x 2400mAh 3.6V Li-SOCl₂ AA Battery
 - ◆ 1.8 years of operation waking up every minute
 - ◆ 7.6 years of operation waking up every 5 minutes
- ◆ Different battery configurations, wake-up schedules and wake-up sources can be used to achieve longer battery life.



28 Cours Jean Jaurès,
38000 Grenoble, France
www.greenwaves-technologies.com
sales@greenwaves-technologies.com



Actipole - CS 10021
364, route de Valence
38113 Veurey-Voroize, France
www.lynred.com
Info@lynred.com